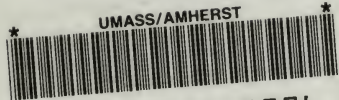


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DEPARTMENT OF REVENUE

BUREAU OF LOCAL ASSESSMENT

STANDARD FOR

CONDUCTING AND EVALUATING RATIO STUDIES

GOVERNMENT DOCUMENTS  
COLLECTION

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MASSACHUSETTS DEPARTMENT OF REVENUE  
BUREAU OF LOCAL ASSESSMENT

STANDARD FOR CONDUCTING AND EVALUATING RATIO STUDIES

Massachusetts General Laws Chapter 58 §1 requires the Commissioner of Revenue to make, and revise "such reasonable rules, regulations, and guidelines, as may be necessary to establish minimum standards of assessment performance." The purpose of this guideline is to establish a standard framework for evaluating the level of assessment in each community.

The assessment / sales ratio study is one of the principal tools used in evaluating the level of assessment. In addition to this guideline, assessors should refer to the International Association of Assessing Officers Standard on Ratio Studies, and the appropriate sections of the IAAO textbook, Property Appraisal and Assessment Administration.

Date of the Analysis

For the purpose of the triennial certification requirement, the effective date of the analysis is the January 1 previous to the fiscal year of certification. For example, for an FY92 certification community, the effective date of the ratio study is January 1, 1991. Since the object of the valuation program is to estimate fair market value as of January 1 of a particular year, the ratio study used to evaluate that valuation program should reflect market conditions as of that same January 1. There are three basic methods commonly used to conduct the ratio study:

1. Sales which occurred between January 1 and December 31 of the previous year, unadjusted for date of sale.
2. Sales which occurred between January 1 and December 31 of the previous year, adjusted for date of sale forward to January 1.
3. Sales, adjusted or unadjusted, that "bracket" the assessment date. For example, for January 1, 1991 valuation date, sales that took place between July 1, 1990 and June 30, 1991.

Adjusting for Date of Sale: The effective date of the ratio study submitted for certification of values is January 1. If method 1, the use of the previous years' sales is selected, all sale prices should be adjusted to the date of sale. If the time adjustment factor for the class of property being analyzed has been documented to be + or - 5% or less per year, this adjustment is not necessary.

### Methods for Developing Time Adjustment Factors

Reference to Appendix 5-3 of the IAAO text is recommended.

There are 4 methods that are typically used to develop time adjustment factors:

1. Paired sales analysis
2. Resales analysis
3. Sales ratio trend analysis
4. Multiple regression analysis

The applicability and acceptability of each method is highly dependent on the volume and quality of the data used in the analysis. The development and use of these factors must be fully documented.

Sales prices are typically adjusted by month or quarter. Annual adjustment factors can be imprecise and should be avoided.

### Property Types Evaluated by Assessment-Sales Ratio Studies

Assessment - sales ratio studies (ASR's) are utilized to evaluate one to three family residential property, apartment, condominiums, and residential vacant land, when a sufficient number of sales exist in the community. It is recommended that the assessor use at least 10 sales in any study. Only "valid", arm's length sales should be used in a ratio study. The following general property groups should serve as the starting point for the ratio study:

<u>Description of Group</u>	<u>State Use Code</u>
Single family residential	101
Condominiums	102
Two Family	104
Three Family	105
Apartments	
Developable Land	130
Potentially Developable Land	131
Undevelopable Land	132

If there is an insufficient number of sales for a particular group, certain categories or groups of properties can be combined to enhance the analysis. For example, use codes 130 through 132 might be combined for analytical purposes. Remedies for insufficient sample size include:

1. Restratification of property groups
2. Extending the period from which sales are drawn
3. Using independent appraisals in lieu of selling price

Next, properties should be stratified to create subgroups for analysis. The following subgroups should be analyzed, if sufficient sales are available:

- \* sale price quartiles
- \* neighborhoods or other locational variables
- building styles
- building age groups
- building size groups
- by sale month or quarter
- \* locational groups (waterfront, water view, etc.)
- \* Condominium complexes (if appropriate)

Those groups marked by an '\*' above should be analyzed by the assessors prior to request for preliminary certification. The request for certification form can be used to summarize this information. For each group analyzed, a spreadsheet should be developed for analytical purposes. It should contain the following minimum level of information:

Date of analysis  
Criteria which identifies the group (i.e. class 101 ranches)  
parcel identifier (tax map #, etc.)  
Street address  
Sale date  
Sale price  
Assessed value  
Assessment/sales ratio  
Median ratio for the group  
Absolute dispersion (about the median)  
Coefficient of dispersion for the group

At the conclusion of the analysis, the results of all the individual ratio studies should be summarized in a tabular format. The summary should indicate the type of property analyzed, the number of sales in the group, the median ratio for the group, and the coefficient of dispersion for each group. This summary form should be available for review by DOR certification personnel.

Prior to making any firm conclusions from the ratio study, it should be determined whether further stratification of data is justified. Stratification is typically justified if there are sufficient sales in the group to make a valuation conclusion.

### Property Types Evaluated by Other Types of Ratio Studies

Due to a lack of sufficient sales, the evaluation of certain types of property may not be suitable for assessment / sales ratio studies. When sufficient land sales are not available, assessors often use various residual techniques to develop residential, commercial, and industrial land schedules. If this is the case, the accuracy and uniformity of the resulting land schedule should be measured by comparing the proposed land value indicated by the schedule, with the value indicated by the residual process previously applied to each property analyzed. Median ratios, and COD's should be produced for each strata of property, as applicable.

### ACCURACY AND RELIABILITY OF DATA ANALYSIS

When reviewing the results of a ratio study, the following points should be considered:

1. The validity and accuracy of any real estate market analysis program is dependent on the use of verified, accurate data. Studies made with unverified sales or property descriptive data is unreliable, and conclusions made from such analysis may be faulty and misleading. A sales verification and inspection program is a critical part of any valuation procedure and will be reviewed during the certification process. Assessors should carefully document the results of the sales verification program. A review of this process should be done as early in the certification process as possible, to avoid unnecessary delays at the final phases.
2. The reliability of the results of any ratio analysis is dependent on the "sample size". The more sales or appraisals analyzed, the more confident the assessor can be that the results reasonably reflect true market conditions. Conclusions made from small samples are likely to be unreliable.
3. The lower the measure of dispersion computed in the study (Coefficient of Dispersion, Coefficient of Variation, standard deviation), the more confident the appraiser can be that the results actually "mirror" the market. High measures of dispersion generally indicate that conclusions made from the analysis may not be reliable.
4. The samples chosen to study (either sales or appraisals) should be representative of the class of property being analyzed. The make-up of the groups studied should be representative of the community as a whole.

5. The analysis of homogeneous groups (stratification) is one of the keys to successful real estate market analysis. Attempting to categorize diverse properties into a single group will likely lead to unsatisfactory or misleading results.
6. The results of the market analysis should be carefully reviewed in its entirety before conclusions are made. Measures of dispersion, such as coefficient of dispersion (COD), standard deviation, and coefficient of variation (COV) should be carefully monitored. A high COD may indicate that further analysis, or even complete revaluation of a type of property is needed. Large differences in assessment ratios between various types or classes of property may indicate a need for a more comprehensive analysis or revaluation decision. As a general rule, variations in the median (or mean) ratio of more than 5 points between individual groups and the largest group (typically single family residential), or a range (difference between the highest and lowest medians) of 10% or more may be indicative potential problems with the valuation process, and should be satisfactorily addressed before preliminary certification can be granted.

#### **Estimating Performance for Unsold Properties**

The assessment / sales ratio study is used because sold properties are considered the best estimate of market performance. The Department will make reasonable checks to ensure that unsold properties have been appraised in a similar, uniform manner when compared to sold properties, and are being appraised at market value levels. One or more of the following methods will be used in making this conclusion:

1. Comparing the principal valuation system variables for selected, sample groups of sold and unsold properties. These valuation variables typically include:
  - Building grade
  - Building condition
  - Story height
  - Physical depreciation factors used
  - Functional obsolescence
  - Economic (locational) obsolescence
  - Locational adjustments
  - Other adjustments, as appropriate
2. Comparison of average value changes of groups of similar sold and unsold properties.
3. Comparison of average unit values between similar groups of sold and unsold properties.

### Ratio Study Performance Standards

1. For each community subject to certification, the median assessment /sales ratio for each of the following types of residential property must be demonstrated to be in the range 90% to 110%. The coefficient of dispersion (COD) calculated with respect to the median ratio should meet the following guidelines:

	<u>Property Type</u>	<u>Coefficient of Dispersion</u>
a.	Single family	10.0%
b.	Two family	12.0%
c.	Three family	12.0%
d.	Apartments	15.0%
e.	Condominiums	10.0%
f.	Vacant land	20.0%

2. The range of median ratios between the largest residential class, as measured by the number of parcels in that class, and any other class, or strata should be 5.0% or less. The median ratio for the above classes should not be less than 90%.

3. When market value indicators other than sales are utilized (i.e. residual analysis, etc.), the median ratio should be in the range of 90% to 110%, and should be within 5% of the ratio computed for the single family residential class.

4. For each class of property having more than 20 sales in the analysis period, the median ratio for each price quartile should be computed. The price quartiles are established by arraying the selling prices from low to high, and dividing them into four groups having approximately equal numbers of sold properties. The median assessment / sales ratio for each group is then identified. The median ratio for each quartile should fall within a range of +/- 5% of the median ratio for the entire class, group, or strata being analyzed.

5. For each class of property having more than 10 but fewer than 20 sales in the analysis period, the sample is divided into two approximately equal halves, and the median ratio for each half is identified. The median ratio for each half should fall within a range of +/- 5% of the median ratio for the entire class, group, or strata being analyzed.

6. For each condominium complex having 10 or more sales, the median assessment /sales ratio should be within 5% of that of the condominium class as a whole.

7. For each neighborhood or similar locational identifier used in the valuation process, a median ratio and coefficient of dispersion should be computed. If sufficient sales exist, this neighborhood analysis should be stratified by property class. The median for each strata analyzed should be within 5% of that of the group as a whole.

### Evaluating the Level of Assessment in the Absence of Sales

The DOR must certify that all classes and types of property are valued at full and fair cash value, not just those in which sufficient numbers of properties have sold to conduct assessment / sales ratio studies. For those property types that lack sufficient sales, assessors should present alternative methods of analysis which support the proposed assessed values as being at market value levels. The following methods are typically used:

1. **Analysis of valuation components:**  
Income producing properties rarely sell in sufficient numbers to use an assessment / sales ratio study to measure assessment level. If the income approach was used to estimate value, the analysis of the basic components of that approach may yield a conclusion as to the acceptable market valuation of these properties. For the income approach, these components typically are:
  - rent schedules
  - vacancy schedules and allowances
  - expense schedules
  - capitalization rate components

For residential properties, the use of a calibrated cost manual may provide an indication of market value levels. The manual must be calibrated to local market conditions, including:

- Land values
- Basic building costs
- Depreciation schedules
- Time / location modifiers

2. **Assessment / Appraisal Studies**  
Assessors can substitute independent appraisals in the ratio study, when sold properties are not available. All of the same guidelines for ratio studies still apply. In the absence of sales within the community, assessors may have to use sales of similar properties from neighboring communities as comparables in the appraisal reports.
3. **Unit Value Comparisons**  
In this method, the appraiser compares the unit values (i.e. price per square foot of land) with those values obtained from either independent appraisals, or sales from neighboring communities.
4. **Supplemental use of listing prices**  
In the absence of sales, the offering prices for properties listed for sale may be an indication of market levels. Listings tend to establish the upper limit of value only, and should be used only with great caution.



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# **RATIO STUDY WORKBOOK**



Department of Revenue  
Bureau of Local Assessment  
Ratio Study Workbook

This workbook attempts to demonstrate certain of the analytical concepts covered in the Bureau's Standard on Ratio Studies. Readers are encouraged to refer to that standard, along with the IAAO Standard on Ratio Studies, and the IAAO textbook, Property Appraisal and Assessment Administration.

The town of Dana is planning an "interim year" adjustment of values. The Board of Assessors has conducted a series of assessment / sales ratio studies to assist them in determining whether changes in assessed values are warranted, and, if so, how the changes are to be carried out. They have collected and verified 33 single family residential sales, which they will analyze first. These sales are displayed in Exhibit #1.

Exhibit #1 - Sales Listing for DANA Fiscal Year XX

Sale #	Neighbhd	Style	Effective Age	Bldg Size	Sale Month	Sale Price Quartile	Sale Price	Assessed Value
1	1	colonial	6	1,052	4	1	\$105,400	\$118,600
2	2	cape	5	1,434	10	1	\$103,900	\$108,400
3	3	cape	25	1,641	5	1	\$91,700	\$102,100
4	4	colonial	27	1,922	4	1	\$96,200	\$110,000
5	3	cape	20	1,128	8	1	\$108,900	\$114,100
6	4	cape	6	1,664	11	1	\$100,200	\$103,200
7	3	cape	19	2,072	5	1	\$115,300	\$125,300
8	3	cape	4	1,832	1	1	\$104,100	\$105,200
9	1	cape	6	1,361	8	1	\$117,400	\$133,600
10	3	cape	8	1,649	12	2	\$145,200	\$142,900
11	4	colonial	28	1,574	12	2	\$145,400	\$145,100
12	3	cape	19	1,154	11	2	\$131,800	\$132,900
13	1	cape	24	1,464	6	2	\$151,500	\$148,900
14	3	colonial	31	1,265	5	2	\$139,600	\$132,500
15	3	cape	19	2,058	4	2	\$128,800	\$124,300
16	5	cape	8	1,204	6	2	\$147,200	\$143,400
17	3	colonial	17	1,879	12	2	\$148,700	\$143,300
18	1	cape	11	2,038	5	3	\$166,200	\$159,000
19	2	cape	23	2,112	10	3	\$159,200	\$155,900
20	5	colonial	33	1,480	3	3	\$190,900	\$183,200
21	2	cape	2	1,529	10	3	\$194,800	\$191,100
22	1	cape	13	1,753	1	3	\$192,100	\$189,600
23	3	colonial	30	1,206	9	3	\$182,300	\$171,900
24	2	colonial	5	1,414	4	3	\$184,300	\$179,500
25	5	colonial	30	1,672	12	3	\$186,200	\$176,400
26	5	cape	35	1,153	4	4	\$201,500	\$175,600
27	1	cape	7	1,462	12	4	\$208,400	\$186,300
28	1	colonial	24	1,743	3	4	\$201,300	\$171,000
29	1	cape	30	1,162	1	4	\$272,400	\$234,400
30	1	cape	8	2,077	5	4	\$254,300	\$213,000
31	1	cape	16	2,159	12	4	\$221,600	\$185,500
32	1	cape	12	1,491	2	4	\$210,900	\$179,500
33	3	cape	12	1,613	11	4	\$207,100	\$186,600

In order to complete the first portion of the ratio analysis, the assessors have:

1. Computed the ratio of assessed value to selling price
2. Sorted the sales in order of the assessment ratio
3. Computed the median assessment ratio
4. Computed the absolute deviation of the ratio of each sale compared to the median ratio
5. Computed the average absolute deviation, Coefficient of Dispersion, Price related differential, and other statistics.

The resulting spreadsheet, with statistics is presented below:

Exhibit #2: Overall Assessment / Sales Ratio Study

Sale #	Neighbhd	Style	Effective Age	Bldg Size	Sale Month	Sale Price Quartile	Sale Price	Assessed Value	Ratio	Disp
31	1	cape	16	2,159	12	4	\$221,600	\$185,500	83.7%	13.7%
30	1	cape	8	2,077	5	4	\$254,300	\$213,000	83.8%	13.6%
28	1	colonial	24	1,743	3	4	\$201,300	\$171,000	84.9%	12.5%
32	1	cape	12	1,491	2	4	\$210,900	\$179,500	85.1%	12.3%
29	1	cape	30	1,162	1	4	\$272,400	\$234,400	86.0%	11.4%
26	5	cape	35	1,153	4	4	\$201,500	\$175,600	87.1%	10.3%
27	1	cape	7	1,462	12	4	\$208,400	\$186,300	89.4%	8.0%
33	3	cape	12	1,613	11	4	\$207,100	\$186,600	90.1%	7.3%
23	3	colonial	30	1,206	9	3	\$182,300	\$171,900	94.3%	3.1%
25	5	colonial	30	1,672	12	3	\$186,200	\$176,400	94.7%	2.7%
14	3	colonial	31	1,265	5	2	\$139,600	\$132,500	94.9%	2.5%
18	1	cape	11	2,038	5	3	\$166,200	\$159,000	95.7%	1.7%
20	5	colonial	33	1,480	3	3	\$190,900	\$183,200	96.0%	1.4%
17	3	colonial	17	1,879	12	2	\$148,700	\$143,300	96.4%	1.0%
15	3	cape	19	2,058	4	2	\$128,800	\$124,300	96.5%	0.9%
24	2	colonial	5	1,414	4	3	\$184,300	\$179,500	97.4%	0.0%
16	5	cape	8	1,204	6	2	\$147,200	\$143,400	97.4%	0.0%
19	2	cape	23	2,112	10	3	\$159,200	\$155,900	97.9%	0.5%
21	2	cape	2	1,529	10	3	\$194,800	\$191,100	98.1%	0.7%
13	1	cape	24	1,464	6	2	\$151,500	\$148,900	98.3%	0.9%
10	3	cape	8	1,649	12	2	\$145,200	\$142,900	98.4%	1.0%
22	1	cape	13	1,753	1	3	\$192,100	\$189,600	98.7%	1.3%
11	4	colonial	28	1,574	12	2	\$145,400	\$145,100	99.8%	2.4%
12	3	cape	19	1,154	11	2	\$131,800	\$132,900	100.8%	3.4%
8	3	cape	4	1,832	1	1	\$104,100	\$105,200	101.1%	3.7%
6	4	cape	6	1,664	11	1	\$100,200	\$103,200	103.0%	5.6%
2	2	cape	5	1,434	10	1	\$103,900	\$108,400	104.3%	6.9%
5	3	cape	20	1,128	8	1	\$108,900	\$114,100	104.8%	7.4%
7	3	cape	19	2,072	5	1	\$115,300	\$125,300	108.7%	11.3%
3	3	cape	25	1,641	5	1	\$91,700	\$102,100	111.3%	13.9%
1	1	colonial	6	1,052	4	1	\$105,400	\$118,600	112.5%	15.1%
9	1	cape	6	1,361	8	1	\$117,400	\$133,600	113.8%	16.4%
4	4	colonial	27	1,922	4	1	\$96,200	\$110,000	114.3%	16.9%
sum							\$5,314,800	\$5,072,300		
									agg mean	95.4%
									mean	97.6%
									median	97.4%
									cod	6.5%
									prd	1.02221

After completing this first level of analysis, certain preliminary conclusions can be made. The median assessment / sales ratio, of 97.6% appears to be on target, indicating that overall, property is being valued in accordance with the law. The coefficient of dispersion of 6.4% indicates an overall high degree of uniformity. The price related differential (PRD), which measures progressivity and/or regressivity, is within the .98 to 1.03 range recommended by the International Association of Assessing Officers.

Since the sales being analyzed fell within the one year period prior to the valuation date, the assessors next attempted to determine whether the sales prices should be adjusted to better reflect the market as of January 1, 19xx. To do this, they first divided the sales base into sales date quartiles (sales occurring in each 3 month period of the year).

As noted in Exhibit #3, results of this study was as follows:

<u>Quarter</u>	<u># of Sales</u>	<u>Median Ratio</u>
1	6	92.0%
2	12	97.4%
3	3	104.8%
4	12	98.0%

The third quarter results, having only 3 sales, were given relatively little weight. Analyzing the three remaining quarters, the increase in assessment ratios may indicate a reduction in market value. The assessors conclude that a 6% annual, or 0.5% per month deflation factor may be warranted.

To provide further backup, the assessors have conducted two additional analytical procedures to estimate their time adjustment factor.

In Exhibit #4, the assessors have identified 9 properties that have sold twice within a period of time. By computing the monthly change in value between the first and second sale, an indication of changes in the overall market can be obtained. This analysis indicates a deflationary trend of 0.8% per month may be justified.

The assessors decided to use an additional method to determine their "time adjustment factor: Paired Sales Analysis. Exhibit # 5 illustrates how this method is carried out. The assessors have identified several "pairs" of properties that are very similar to each other, differing primarily by date of sale. By "adjusting" one of the sales to the other, all differences other than sale date can be accounted for.

In this example, the two properties are identical except that Sale #1 has 2 bathrooms, and #2 has 2 1/2 baths. In addition, #1 has a lot which is 2,000 feet larger than that of #2. The assessors have determined from the local "market" that an extra half bath contributes \$1,000 to value, so they have adjusted Sale #1 by adding the value of the half bath. Similarly, The \$2,000 value of the extra lot size has been subtracted from sale #1. Since these properties have been adjusted so they are equivalent, any difference in value is likely to be due to differences in sale date. The indication is that a 0.50% per month deflationary adjustment is warranted.

**Exhibit # 3: Ratio Study by Date of Sale**

Sale #	Neighbhd	Style	Effective Age	Bldg Size	Sale Month	Sale Price	Sale Price	Assessed Value	Ratio	Disp
						Quartile				
28	1	colonial	24	1,743	3	4	\$201,300	\$171,000	84.9%	7.1%
32	1	cape	12	1,491	2	4	\$210,900	\$179,500	85.1%	6.9%
29	1	cape	30	1,162	1	4	\$272,400	\$234,400	86.0%	6.0%
20	5	colonial	33	1,480	3	3	\$190,900	\$183,200	96.0%	4.0%
22	1	cape	13	1,753	1	3	\$192,100	\$189,600	98.7%	6.7%
8	3	cape	4	1,832	1	1	\$104,100	\$105,200	101.1%	9.1%
									mean	6.6%
									median	92.0%
									cod	7.2%
15	3	cape	19	2,058	4	2	\$128,800	\$124,300	96.5%	0.9%
4	4	colonial	27	1,922	4	1	\$96,200	\$110,000	114.3%	16.9%
1	1	colonial	6	1,052	4	1	\$105,400	\$118,600	112.5%	15.1%
26	5	cape	35	1,153	4	4	\$201,500	\$175,600	87.1%	10.3%
24	2	colonial	5	1,414	4	3	\$184,300	\$179,500	97.4%	0.0%
30	1	cape	8	2,077	5	4	\$254,300	\$213,000	83.8%	13.6%
14	3	colonial	31	1,265	5	2	\$139,600	\$132,500	94.9%	2.5%
18	1	cape	11	2,038	5	3	\$166,200	\$159,000	95.7%	1.7%
16	5	cape	8	1,204	6	2	\$147,200	\$143,400	97.4%	0.0%
13	1	cape	24	1,464	6	2	\$151,500	\$148,900	98.3%	0.9%
7	3	cape	19	2,072	5	1	\$115,300	\$125,300	108.7%	11.3%
3	3	cape	25	1,641	5	1	\$91,700	\$102,100	111.3%	13.9%
									mean	6.3%
									median	97.4%
									cod	6.4%
9	1	cape	6	1,361	8	1	\$117,400	\$133,600	113.8%	16.4%
5	3	cape	20	1,128	8	1	\$108,900	\$114,100	104.8%	7.4%
23	3	colonial	30	1,206	9	3	\$182,300	\$171,900	94.3%	3.1%
2	2	cape	5	1,434	10	1	\$103,900	\$108,400	104.3%	6.3%
31	1	cape	16	2,159	12	4	\$221,600	\$185,500	83.7%	14.3%
27	1	cape	7	1,462	12	4	\$208,400	\$186,300	89.4%	8.6%
33	3	cape	12	1,613	11	4	\$207,100	\$186,600	90.1%	7.9%
25	5	colonial	30	1,672	12	3	\$186,200	\$176,400	94.7%	3.3%
17	3	colonial	17	1,879	12	2	\$148,700	\$143,300	96.4%	1.6%
19	2	cape	23	2,112	10	3	\$159,200	\$155,900	97.9%	0.1%
21	2	cape	2	1,529	10	3	\$194,800	\$191,100	98.1%	0.1%
10	3	cape	8	1,649	12	2	\$145,200	\$142,900	98.4%	0.4%
11	4	colonial	28	1,574	12	2	\$145,400	\$145,100	99.8%	1.8%
12	3	cape	19	1,154	11	2	\$131,800	\$132,900	100.8%	2.8%
6	4	cape	6	1,664	11	1	\$100,200	\$103,200	103.0%	5.0%
									mean	4.2%
									median	98.0%
									cod	4.3%

# Exhibit # 4: Resales Analysis

Sale #	Use Code	Date of 1st Sale	Sale Price 1st Sale	Date of 2nd Sale	Sale Price 2nd Sale	Time Between Sales (months)	Monthly Rate Of Change
1	101	15-SEP-1989	\$100,000	03-APR-1990	\$90,000	6.67	-1.50X
2	101	20-OCT-1989	\$125,000	16-AUG-1990	\$115,000	10.00	-0.80X
3	101	24-NOV-1989	\$200,000	29-DEC-1990	\$180,000	13.33	-0.75X
4	101	29-DEC-1989	\$226,500	13-MAY-1991	\$195,500	16.67	-0.82X
5	101	02-FEB-1990	\$156,900	15-OCT-1991	\$125,000	20.67	-0.98X
6	101	09-MAR-1990	\$190,200	14-NOV-1990	\$180,000	8.33	-0.64X
7	101	29-NOV-1989	\$115,000	30-OCT-1991	\$125,000	23.33	0.37X
8	101	03-JAN-1990	\$155,000	26-AUG-1991	\$138,000	20.00	-0.55X
9	101	07-FEB-1990	\$250,000	15-OCT-1990	\$210,000	8.33	-1.92X
Mean						14.15	-0.84X
Median							-0.80X

# Exhibit #5: Paired Sales Analysis

	Sale #1	Adjustment	Sale #2
Sale Price	\$150,000		\$140,000
Sale Date	07-JUN-1989		16-AUG-1991
Style	Colonial		Colonial
Size (sf)	2100		2275
Effective Age	22		22
Neighborhood	10		10
Baths	2	\$1,000	2.5
Quality	Good		Good
Garage	No		No
Fireplace	1		1
Basement	Full		Full
Lot size	22,000	-\$2,000	20,000
Adjusted Sale Price	\$149,000		\$140,000
Adjusted Price/SF	\$70.95		\$61.54
Net Price Change/sf	\$9.41		
% Change	13.27X		
Months between sales	26.67		
Monthly Change	0.50X		

Based on the above analysis, the assessors have concluded that a time adjustment of -0.5% per month on selling prices is warranted. Since all sales occurred in the year prior to the assessment date, all the adjustments will be negative. The following spreadsheet, which averages all sales to the end of the month, illustrates the ratio study based on time adjusted selling prices. Notice that the median ratio, which was 97.6%, has now risen to 99.8%.

Sale #	Neighbhd	Style	Effect Age	Bldg Size	Sale Month	Sale Price Quartile	Sale Price	Time Adjust Price	Assessed Value	Ratio (Adjust)	Disp
31	1	cape	16	2,159	12	4	\$221,600	\$221,600	\$185,500	83.7%	16.1%
30	1	cape	8	2,077	5	4	\$254,300	\$245,400	\$213,000	86.8%	13.0%
28	1	colonial	24	1,743	3	4	\$201,300	\$192,242	\$171,000	89.0%	10.8%
27	1	cape	7	1,462	12	4	\$208,400	\$208,400	\$186,300	89.4%	10.4%
32	1	cape	12	1,491	2	4	\$210,900	\$200,355	\$179,500	89.6%	10.2%
33	3	cape	12	1,613	11	4	\$207,100	\$206,065	\$186,600	90.6%	9.2%
26	5	cape	35	1,153	4	4	\$201,500	\$193,440	\$175,600	90.8%	9.0%
29	1	cape	30	1,162	1	4	\$272,400	\$257,418	\$234,400	91.1%	8.7%
25	5	colonial	30	1,672	12	3	\$186,200	\$186,200	\$176,400	94.7%	5.1%
23	3	colonial	30	1,206	9	3	\$182,300	\$179,566	\$171,900	95.7%	4.1%
17	3	colonial	17	1,879	12	2	\$148,700	\$148,700	\$143,300	96.4%	3.4%
14	3	colonial	31	1,265	5	2	\$139,600	\$134,714	\$132,500	98.4%	1.4%
10	3	cape	8	1,649	12	2	\$145,200	\$145,200	\$142,900	98.4%	1.4%
19	2	cape	23	2,112	10	3	\$159,200	\$157,608	\$155,900	98.9%	0.9%
21	2	cape	2	1,529	10	3	\$194,800	\$192,852	\$191,100	99.1%	0.7%
18	1	cape	11	2,038	5	3	\$166,200	\$160,383	\$159,000	99.1%	0.7%
11	4	colonial	28	1,574	12	2	\$145,400	\$145,400	\$145,100	99.8%	0.0%
16	5	cape	8	1,204	6	2	\$147,200	\$142,784	\$143,400	100.4%	0.6%
20	5	colonial	33	1,480	3	3	\$190,900	\$182,310	\$183,200	100.5%	0.7%
15	3	cape	19	2,058	4	2	\$128,800	\$123,648	\$124,300	100.5%	0.7%
13	1	cape	24	1,464	6	2	\$151,500	\$146,955	\$148,900	101.3%	1.5%
12	3	cape	19	1,154	11	2	\$131,800	\$131,141	\$132,900	101.3%	1.5%
24	2	colonial	5	1,414	4	3	\$184,300	\$176,928	\$179,500	101.5%	1.7%
6	4	cape	6	1,664	11	1	\$100,200	\$99,699	\$103,200	103.5%	3.7%
22	1	cape	13	1,753	1	3	\$192,100	\$181,535	\$189,600	104.4%	4.6%
2	2	cape	5	1,434	10	1	\$103,900	\$102,861	\$108,400	105.4%	5.6%
5	3	cape	20	1,128	8	1	\$108,900	\$106,722	\$114,100	106.9%	7.1%
8	3	cape	4	1,832	1	1	\$104,100	\$98,375	\$105,200	106.9%	7.1%
7	3	cape	19	2,072	5	1	\$115,300	\$111,265	\$125,300	112.6%	12.8%
3	3	cape	25	1,641	5	1	\$91,700	\$88,491	\$102,100	115.4%	15.6%
9	1	cape	6	1,361	8	1	\$117,400	\$115,052	\$133,600	116.1%	16.3%
1	1	colonial	6	1,052	4	1	\$105,400	\$101,184	\$118,600	117.2%	17.4%
4	4	colonial	27	1,922	4	1	\$96,200	\$92,352	\$110,000	119.1%	19.3%

sum \$5,314,800 \$5,176,841 \$5,072,300

agg mean	98.0%	
mean	100.1%	6.7%
median	99.8%	
cod		6.7%
prd		1.022

In Exhibit #6, the assessors have completed ratio analysis on the five neighborhoods in the town, with the following tabulated results:

<u>Neighborhood #</u>	<u># of Sales</u>	<u>Median Ratio</u>	<u>COD</u>
1	11	89.4%	9.7%
2	4	98.0%	1.8%
3	11	98.4%	5.1%
4	3	103.0%	4.7%
5	4	95.4%	2.1%

Several of the neighborhood do not have enough sales to make valid conclusions(2,3, & 4), even though the median ratios in two of them fall close to the overall median. The assessors may want to combine several similar areas for analysis. Additional analysis in neighborhood 4 might be considered, due to the median ratio of 103%, though having only four sale makes any conclusion difficult. Neighborhood #1 stands out, however, with a median of 89.4% compared to the overall median of 97.4%. Additional analysis is warranted, before deciding on a potential course of action to correct this problem.

The next analyses that were completed were ratio studies based on building style, and building size, with the following tabulated results:

<u>Style</u>	<u># of Sales</u>	<u>Median Ratio</u>	<u>COD</u>
Cape	23	98.1%	6.7%
Colonial	10	96.2%	5.8%

<u>Building Size</u>	<u># of Sales</u>	<u>Median Ratio</u>	<u>COD</u>
1,052 to 1529	16	97.4%	6.4%
1,530 to 2,159	17	97.9%	6.6%

Both analysis indicate good results: uniform assessing at market value levels. Similar results were obtained for a study on building age.

The assessors next conducted the ratio study by style within each neighborhood. The results are tabulated:

<u>Style</u>	<u>Neighborhood</u>	<u># Sales</u>	<u>Median Ratio</u>	<u>COD</u>
Cape	1	9	89.4%	8.43%
Cape	2	3	98.1%	
Cape	3	8	100.1%	5.0%
Cape	4	3	97.4%	
Colonial	1	2	98.7%	
Colonial	2	1	97.4%	
Colonial	3	3	94.9%	
Colonial	4	4	97.9	

Several of the strata do not have a sufficient number of sales to make a valid conclusion. However, Capes in neighborhood 1 seem to stand out, with an 89.4% ratio. In order to "equalize" this strata to the overall median of 97.4%, the assessments of these properties (capes in neighborhood 4) were adjusted by an effective factor of 1.09. Additional analysis (not illustrated here) was conducted to allocate this adjustment between land and building, yielding an overall adjustment factor of 1.09. The ratio studies were then rerun. The median ratio for capes in neighborhood #1 increased from 89.4% to 97.5%, with almost no change in COD. The overall median ratio increased slightly, from 97.4% to 97.9%, while the COD declined slightly from 6.5% to 6.3%.

# Exhibit #6 - Neighborhood Analysis

Sale #	Neighbhd	Style	Effective Age	Bldg Size	Sale Month	Sale Price Quartile	Sale Price	Assessed Value	Ratio	Disp
31	1	cape	16	2,159	12	4	\$221,600	\$185,500	83.7%	5.7%
30	1	cape	8	2,077	5	4	\$254,300	\$213,000	83.8%	5.6%
28	1	colonial	24	1,743	3	4	\$201,300	\$171,000	84.9%	4.5%
32	1	cape	12	1,491	2	4	\$210,900	\$179,500	85.1%	4.3%
29	1	cape	30	1,162	1	4	\$272,400	\$234,400	86.0%	3.4%
27	1	cape	7	1,462	12	4	\$208,400	\$186,300	89.4%	0.0%
18	1	cape	11	2,038	5	3	\$166,200	\$159,000	95.7%	6.3%
13	1	cape	24	1,464	6	2	\$151,500	\$148,900	98.3%	8.9%
22	1	cape	13	1,753	1	3	\$192,100	\$189,600	98.7%	9.3%
1	1	colonial	6	1,052	4	1	\$105,400	\$118,600	112.5%	23.1%
9	1	cape	6	1,361	8	1	\$117,400	\$133,600	113.8%	24.4%
								mean	93.8%	
								median	89.4%	
								cod		9.7%
24	2	colonial	5	1,414	4	3	\$184,300	\$179,500	97.4%	0.6%
19	2	cape	23	2,112	10	3	\$159,200	\$155,900	97.9%	0.1%
21	2	cape	2	1,529	10	3	\$194,800	\$191,100	98.1%	0.1%
2	2	cape	5	1,434	10	1	\$103,900	\$108,400	104.3%	6.3%
								mean	99.4%	
								median	98.0%	
								cod		1.8%
33	3	cape	12	1,613	11	4	\$207,100	\$186,600	90.1%	7.3%
23	3	colonial	30	1,206	9	3	\$182,300	\$171,900	94.3%	3.1%
14	3	colonial	31	1,265	5	2	\$139,600	\$132,500	94.9%	2.5%
17	3	colonial	17	1,879	12	2	\$148,700	\$143,300	96.4%	1.0%
15	3	cape	19	2,058	4	2	\$128,800	\$124,300	96.5%	0.9%
10	3	cape	8	1,649	12	2	\$145,200	\$142,900	98.4%	1.0%
12	3	cape	19	1,154	11	2	\$131,800	\$132,900	100.8%	3.4%
8	3	cape	4	1,832	1	1	\$104,100	\$105,200	101.1%	3.7%
5	3	cape	20	1,128	8	1	\$108,900	\$114,100	104.8%	7.4%
7	3	cape	19	2,072	5	1	\$115,300	\$125,300	108.7%	11.3%
3	3	cape	25	1,641	5	1	\$91,700	\$102,100	111.3%	13.9%
								mean	99.8%	
								median	98.4%	
								cod		5.1%
11	4	colonial	28	1,574	12	2	\$145,400	\$145,100	99.8%	3.2%
6	4	cape	6	1,664	11	1	\$100,200	\$103,200	103.0%	0.0%
4	4	colonial	27	1,922	4	1	\$96,200	\$110,000	114.3%	11.3%
								mean	105.7%	
								median	103.0%	
								cod		4.7%
26	5	cape	35	1,153	4	4	\$201,500	\$175,600	87.1%	8.2%
25	5	colonial	30	1,672	12	3	\$186,200	\$176,400	94.7%	0.6%
20	5	colonial	33	1,480	3	3	\$190,900	\$183,200	96.0%	0.6%
16	5	cape	8	1,204	6	2	\$147,200	\$143,400	97.4%	2.1%
								mean	93.8%	
								median	95.4%	
								cod		2.9%

The final study was done based on sales price quartiles. In this case, the sales data base was divided into four approximately equal groups, based on selling prices sorted from low to high. Two studies were done: the first using the "original" values, the second with the "updated values. The details are illustrated in Exhibit #7, and summarized below:

<u>Price Range</u>	<u># of Sales</u>	<u>Original Median Ratio</u>	<u>Updated median Ratio</u>
\$91,700 to \$117,400	9	108.7%	108.7%
\$131,800 to \$151,800	8	97.9%	97.9%
\$159,299 to \$194,800	8	96.7%	97.7%
\$201,300 to \$272,400	9	85.6%	91.2%

Even without the updating of capes in neighborhood #1, this study indicates potential problems. There appears to be a difference in the level of assessing between "low" and "high" priced houses of 23%. In other words, owners of low priced houses are being over assessed, while owners of high priced houses appear to be under assessed. The first valuation adjustment has helped, reducing the variation between the high and low priced groups from 23% to 17%. However, more work needs to be done, as this statistic still indicates a "regressive" valuation program.

# Exhibit #7 - Ratio Study by Sales Price Quartiles

Sale #	Neighbhd	Style	Effect Age	Bldg Size	Sale Month	Sale Price Quartile	Sale Price	Assessed Value	Ratio	Disp
\$91,700 to 117,400										
8	3	cape	4	1,832	1	1	\$104,100	\$105,200	101.1X	7.6X
6	4	cape	6	1,664	11	1	\$100,200	\$103,200	103.0X	5.7X
2	2	cape	5	1,434	10	1	\$103,900	\$108,400	104.3X	4.4X
5	3	cape	20	1,128	8	1	\$108,900	\$114,100	104.8X	3.9X
7	3	cape	19	2,072	5	1	\$115,300	\$125,300	108.7X	0.0X
3	3	cape	25	1,641	5	1	\$91,700	\$102,100	111.3X	2.6X
1	1	colonial	6	1,052	4	1	\$105,400	\$118,600	112.5X	3.8X
9	1	cape	6	1,361	8	1	\$117,400	\$133,600	113.8X	5.1X
4	4	colonial	27	1,922	4	1	\$96,200	\$110,000	114.3X	5.6X
Mean									108.2X	4.3X
Median									108.7X	
COD										4.0X
\$131,800 to \$151,800										
14	3	colonial	31	1,265	5	2	\$139,600	\$132,500	94.9X	3.0X
17	3	colonial	17	1,879	12	2	\$148,700	\$143,300	96.4X	1.5X
15	3	cape	19	2,058	4	2	\$128,800	\$124,300	96.5X	1.4X
16	5	cape	8	1,204	6	2	\$147,200	\$143,400	97.4X	0.5X
13	1	cape	24	1,464	6	2	\$151,500	\$148,900	98.3X	0.4X
10	3	cape	8	1,649	12	2	\$145,200	\$142,900	98.4X	0.5X
11	4	colonial	28	1,574	12	2	\$145,400	\$145,100	99.8X	1.9X
12	3	cape	19	1,154	11	2	\$131,800	\$132,900	100.8X	2.9X
Mean									97.8X	1.5X
Median									97.9X	
COD										1.5X
\$159,200 to 194,800										
23	3	colonial	30	1,206	9	3	\$182,300	\$171,900	94.3X	2.4X
25	5	colonial	30	1,672	12	3	\$186,200	\$176,400	94.7X	2.0X
18	1	cape	11	2,038	5	3	\$166,200	\$159,000	95.7X	1.0X
20	5	colonial	33	1,480	3	3	\$190,900	\$183,200	96.0X	0.7X
24	2	colonial	5	1,414	4	3	\$184,300	\$179,500	97.4X	0.7X
19	2	cape	23	2,112	10	3	\$159,200	\$155,900	97.9X	1.2X
21	2	cape	2	1,529	10	3	\$194,800	\$191,100	98.1X	1.4X
22	1	cape	13	1,753	1	3	\$192,100	\$189,600	98.7X	2.0X
Mean									96.6X	1.4X
Median									96.7X	
COD										1.5X
\$201,300 to 272,400										
31	3	cape	16	2,159	12	4	\$221,600	\$185,500	83.7X	1.9X
30	3	cape	8	2,077	5	4	\$254,300	\$213,000	83.8X	1.8X
28	1	colonial	24	1,743	3	4	\$201,300	\$171,000	84.9X	0.7X
32	1	cape	12	1,491	2	4	\$210,900	\$179,500	85.1X	0.5X
29	4	cape	30	1,162	1	4	\$272,400	\$234,400	86.0X	0.4X
26	5	cape	35	1,153	4	4	\$201,500	\$175,600	87.1X	1.5X
27	1	cape	7	1,462	12	4	\$208,400	\$186,300	89.4X	3.8X
33	3	cape	12	1,613	11	4	\$207,100	\$186,600	90.1X	4.5X
Mean									86.3X	1.9X
Median									85.6X	
COD										2.2X



